

CLAIMS

What is claimed is:

1 1. A satellite communications system, comprising:  
2 a ground station, including communications equipment  
3 and an antenna, located at a position on the earth;  
4 a plurality of satellites in orbits around the earth  
5 having apogees and perigees, each of the satellites having  
6 communications equipment thereon configured to communicate  
7 with the ground station only during a predetermined portion  
8 of the satellite's orbit proximate to apogee, the orbits of  
9 the plurality of satellites being configured to form at  
10 least two ground tracks on the earth displaced from each  
11 other longitudinally, each of the ground tracks repeating  
12 daily and having a number of active arcs, each active arc  
13 corresponding to the portion of the orbit of each satellite  
14 during which the communications equipment on the satellite  
15 is enabled to communicate with the ground station, the  
16 orbits of the plurality of satellites being further  
17 configured such that at all times there are at least two of  
18 the satellites in each of the active arcs and such that at  
19 all times each of the satellites in any one of the active  
20 arcs is separated by at least a predetermined angle, as  
21 observed from the ground station, from each other satellite  
22 in the same active arc and from any satellite in any other  
23 active arc.

1 2. A system according to claim 1, wherein the orbit of  
2 each of the plurality of satellites has a mean motion that  
3 is one of 2, 3 and 4.

1 3. A system according to claim 1, wherein the orbits of  
2 each of the plurality of satellites is inclined at critical  
3 inclination.

1 4. A system according to claim 1, wherein the argument of  
2 perigee of the orbits of each of the plurality of  
3 satellites is in the range of 195 degrees to 345 degrees  
4 for apogees in the northern hemisphere and in the range of  
5 15 degrees to 165 degrees for apogees in the southern  
6 hemisphere.

1 5. A system according to claim 1, wherein each of the  
2 plurality of satellites has throughout its orbit an orbital  
3 height lower than a height necessary for geostationary  
4 orbits.

1 6. A system according to claim 1, wherein the plurality  
2 of satellites are equally spaced in mean anomaly within  
3 their respective ground tracks.

1 7. A system according to claim 1, wherein the orbits of  
2 the plurality of satellites are further configured such  
3 that the portion of the orbits during which the  
4 communications equipment on the satellites is enabled to  
5 communicate, is separated from the equatorial plane of the  
6 earth by at least a predetermined amount.

1 8. A system according to claim 1, wherein the  
2 communications equipment on the plurality of satellites is  
3 further configured to communicate at frequencies allocated  
4 to geostationary satellites.

1 9. A system according to claim 1, wherein each of the  
2 plurality of satellites has a power system configured to  
3 generate a first amount of power when the communications  
4 equipment on the satellite is enabled and a second amount  
5 of power more than the first amount of power when the  
6 communications equipment is not enabled, to store excess  
7 power generated when the communications equipment is not  
8 enabled, and to enable the communications equipment with  
9 both the stored excess power and the generated first amount  
10 of power.

1 10. A constellation of satellites, comprising:  
2 a plurality of satellites in orbits around the earth  
3 having apogees and perigees, each of the satellites having  
4 communications equipment thereon configured to communicate  
5 only during a predetermined portion of the satellite's  
6 orbit proximate to apogee, the orbits of the plurality of  
7 satellites being configured to form at least two ground  
8 tracks on the earth displaced from each other  
9 longitudinally, each of the ground tracks repeating daily  
10 and having a number of active arcs, each active arc  
11 corresponding to the portion of the orbit of each satellite  
12 during which the communications equipment on the satellite  
13 is enabled to communicate, the orbits of the plurality of  
14 satellites being further configured such that at all times  
15 there are at least two of the satellites in each of the  
16 active arcs and such that at all times each of the  
17 satellites in any one of the active arcs is separated by at  
18 least a predetermined angle, as observed from the earth,  
19 from each other satellite in the same active arc and from  
20 any satellite in any other active arc.

1 11. A constellation according to claim 10, wherein the  
2 orbit of each of the plurality of satellites has a mean  
3 motion that is one of 2, 3 and 4.

1 12. A constellation according to claim 10, wherein the  
2 orbit of each of the plurality of satellites is inclined at  
3 critical inclination.

1 13. A constellation according to claim 10, wherein the  
2 argument of perigee of the orbits of each of the plurality  
3 of satellites is in the range of 195 degrees to 345 degrees  
4 for apogees in the northern hemisphere and in the range of  
5 15 degrees to 165 degrees for apogees in the southern  
6 hemisphere.

1 14. A constellation according to claim 10, wherein each of  
2 the plurality of satellites has throughout its orbit a  
3 orbital height lower than a height necessary for  
4 geostationary orbits.

1 15. A constellation according to claim 10, wherein the  
2 satellites in each of the two or more ground tracks are  
3 equally spaced in mean anomaly.

1 16. A constellation according to claim 10, wherein the  
2 orbit of each of the plurality of satellites is further  
3 configured such that the portion of the orbits during which  
4 the communications equipment on the satellites is enabled  
5 to communicate, is separated from the equatorial plane of  
6 the earth by a least a predetermined amount.

1 17. A constellation according to claim 10, wherein the  
2 communications equipment on each of the plurality of  
3 satellites is further configured to communicate at  
4 frequencies allocated to geostationary satellites.

1 18. A constellation according to claim 10, wherein each of  
2 the plurality of satellites has a power system configured  
3 to generate a first amount of power when the communications  
4 equipment on the satellite is enabled and a second amount  
5 of power more than the first amount of power when the  
6 communications equipment is not enabled, to store excess  
7 power generated when the communications equipment is not  
8 enabled, and to enable the communications equipment with  
9 both the stored excess power and the generated first amount  
10 of power.

1 19. A method for satellite communications, comprising:  
2 orbiting a plurality of communications satellites  
3 about the earth, the orbits having apogees and perigees;  
4 and  
5 enabling each of the plurality of communications  
6 satellites to communicate only during a predetermined  
7 portion of the orbits proximate to apogee;  
8 wherein the orbits of the plurality satellites form at  
9 least two ground tracks on the earth displaced from each  
10 other longitudinally, each of the ground tracks repeating  
11 daily and having a number of active arcs, each active arc  
12 corresponding to the portion of the orbit of each satellite  
13 during which the communications equipment on the satellite  
14 is enabled to communicate; and  
15 wherein the satellites are orbited such that at all  
16 times at least two of the satellites are in each of the

17 active arcs and such that at all times each of the  
18 satellites in any one of the active arcs is separated by at  
19 least a predetermined angle, as observed from the earth,  
20 from each other satellite in the same active arc and from  
21 any satellite in any other active arc.

1 20. A method according to claim 19, further comprising:  
2 configuring the orbits of each of the plurality of  
3 satellites to have a mean motion that is one of 2, 3 and 4.

1 21. A method according to claim 19, further comprising:  
2 configuring the orbits of each of the plurality of  
3 satellites to be inclined at critical inclination.

1 22. A method according to claim 19, further comprising:  
2 configuring the argument of perigee of the orbits of  
3 each of the plurality of satellites to be in the range of  
4 195 degrees to 345 degrees for apogees in the northern  
5 hemisphere and in the range of 15 degrees to 165 degrees  
6 for apogees in the southern hemisphere.

1 23. A method according to claim 19, further comprising:  
2 configuring the orbits of each of the plurality of  
3 satellites to have throughout its orbit an orbital height  
4 lower than a height necessary for geostationary orbits.

1 24. A method according to claim 19, further comprising:  
2 configuring the orbits of the plurality of satellites  
3 such that the satellites are equally spaced in mean anomaly  
4 within their respective ground tracks.

1 25. A method according to claim 19, further comprising:

2       configuring the orbits of the plurality of satellites  
3   such that the portion of the orbits during which the  
4   satellites are enabled for communication, is separated from  
5   the equatorial plane of the earth by at least a  
6   predetermined amount.

1   26. A method according to claim 19, further comprising:  
2       communicating with the plurality of satellites at  
3   frequencies allocated to geostationary satellites.

1   27. A method according to claim 19, wherein each of the  
2   plurality of satellites has a power system generating a  
3   first amount of power when the communications equipment on  
4   the satellite is enabled and a second amount of power more  
5   than the first amount of power when the communications  
6   equipment is not enabled, and further comprising:  
7       storing excess power generated when the communications  
8   equipment is not enabled; and  
9       enabling the communications equipment with both the  
10   stored excess power and the generated first amount of  
11   power.